Un score pour évaluer la stabilité au cours de la marche : méthodologie et validation chez le patient atteint d'ataxie de Friedreich

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Mots clés : Score ; Marche ; Stabilité dynamique ; Paramètres spatiotemporels

Objectif.– Les paramètres spatiotemporels (PST) sont les paramètres quantifiables les plus utilisés pour évaluer la marche et estimer le risque de chute. Deux aspects de l'équilibre—que nous nommerons en nous inspirant de la sémantique utilisée en posturologie pour étudier l'équilibre statique [1]—doivent être pris en compte : « steadiness » et « stability ». Le premier désignera l'ensemble des modifications des PST qui tendent à minimiser les déséquilibres et à en faciliter le contrôle, le second constituera la faculté de répondre efficacement aux perturbations internes ou externes présentes pendant la marche. Si le *Functional Ambulation Performance Score* [2,3] permet d'évaluer l'aspect « steadiness », il n'existe rien concernant la stabilité dynamique. Pour cela, nous proposons un nouveau score.

Méthodes.– La marche de 219 sujets a été enregistrée avec un tapis GAITRite. Neuf PST ont été retenus pour développer un score à partir d'une analyse en composantes principales. Basé sur la quantification des variations des PST au travers des pas et cycles successifs, ce score évalue l'aspect stabilité dynamique au cours de la marche.

Résultats.– Alors que des sujets sains (123, 22–62 ans) présentent un score moyen de 100 (± 7), celui-ci diminue chez les patients lorsque la variabilité et l'instabilité augmentent. Les scores de patients atteints d'Ataxie de Friedreich (95, 12–26 ans), marchant seuls ou avec déambulateur, sont également présentés (67 ± 9). La reproductibilité du score, en cours d'analyse, semble bonne chez les sujets sains et les sujets instables.

Discussion.– Le score développé caractérise la stabilité dynamique de la marche via la variabilité des PST. Utilisé en parallèle au FAPS, il permet d'évaluer de façon complète l'équilibre dynamique du patient lorsqu'il marche.

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Evolution des troubles locomoteurs et posturaux chez les patients infectés par le VIH-1 au sein de la cohorte ANRS CO3 Aquitaine

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Dans une précédente étude transversale [1], la prévalence des troubles locomoteurs et posturaux (performance à plus d'un test clinique inférieure aux normes établies dans la littérature) a été estimée à 29 % (IC 95 % : 24 ; 34) chez 324 patients VIH de la Cohorte ANRS CO3 Aquitaine. Le test du cinq levers de chaise était le plus fréquemment altéré.

Objectif.– Décrire l'évolution des performances locomotrices et posturales après deux années de suivi, des patients inclus dans la phase transversale évoquée ci-dessus.

Méthode.– Il s'agit d'une étude longitudinale, prospective. La même batterie de tests standardisés et validés, explorant différents domaines de la fonction locomotrice et posturale (échelle de Berg, timed up and go test, appui unipodal yeux fermés, test de 6 minutes de marche, cinq levers de chaise) a été administrée. Une mesure de la force isométrique de préhension a également été effectuée.

Résultats.– Les résultats des 97 premiers patients inclus dans la phase longitudinale sont décrits. Les performances moyennes du 5 levers de chaise (10,7 s vs 9,9 initialement) et du test de 6 minutes (511 m vs 572 m initialement, $p < 0{,}001$) se sont dégradées de manière significative. Les patients ayant dégradé leur temps de 5 levers de chaise de plus de 2 s avaient une force isométrique de préhension moins importante que les autres (36 ± 9 kg vs 43 ± 8 kg, $p = 0{,}01$). Aucune dégradation n'a en revanche été constatée concernant les autres tests cliniques.

Conclusion.– Après deux ans de suivi, les performances à deux tests cliniques faisant notamment appel à la puissance et à l'endurance musculaires semblent se dégrader. Toutefois, il s'agit de résultats descriptifs préliminaires qui devront être confirmés par des analyses incluant l'ensemble des patients inclus. La possibilité d'un processus sarcopénique ou dynapénique survenant de manière plus précoce dans cette population est évoquée.

Référence

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Version anglaise

CO16-001–EN

Functional anatomy of motor control

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Clinical and neuromechanical assessments of the spastic equinus foot

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Objectives.– To provide a complete and objective assessment of the patient with a spastic equinus foot in the preoperative evaluation, to study the effect of lidocaine in the context of an anesthetic block of the superior soleus nerve (SSN), and to compare these effects to those of a selective tibial neurotomy.

Patients and methods.– Twenty patients with disabling spastic equinus foot were prospectively enrolled in this study. Patients were evaluated before and after lidocaine block of the SSN, and after selective tibial neurotomy (early and late). Twenty-five clinical parameters were analyzed (foot deformity, Ashworth score, score of the stretch reflex, Physician Rating Scale [PRS]. . .). The motoneuronal

excitability was studied by collecting responses H, M and T, and the stiffness of the ankle in passive conditions measured by applying sinusoidal perturbations.
Results.– Spastic equinovarus foot is associated with reflex hyperexcitability (ratios Hmax/Mmax average: 0.73; and T/Mmax: 0.66) related to central hyperexcitability plus hyper solicitation of muscle receptors to stretching related to the increased stiffness of visco elastic structures of the ankle (ankle passive stiffness measured average at 64 Nm/rad). This increase in passive stiffness is most probably linked with changes in elastic properties of spastic muscle and also with increased muscle rest tone by increasing the number of residual actin-myosin bridges. Lidocaine block causes a clinical improvement of all parameters associated with a decrease in reflex excitability (ratios Hmax/Mmax average: 0.24; and T/Mmax: 0.12 after block) and a significant decrease in stiffness (measured in passive condition) of 17% on average. The dominant effect of lidocaine is on the Ia afferent fibers but also by an action on the spindle sensitivity and resting muscle tone. The lidocaine block reproduces the effect of selective tibial neurotomy on all clinical and neuromechanical parameters.
Conclusion.– We validated a complete neuromechanical protocol to study the spastic equinus foot in which it would be interesting to add the gait analysis laboratory. We show the stable long-term effectiveness of selective tibial neurotomy in the treatment of the spastic equinus foot and finally the predictivity of the lidocaine block.

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Evaluation of the relationships between spasticity, motor deficit, kinematics and function, during a reaching movement in hemiparetic patients

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Keywords: Reaching; Hemiparesis; Spasticity; Function; Kinematics; Isokinetic dynamometer
Objectives.– This study aims at evaluating the relationships between motor deficit, spasticity and kinematics of the upper limb in hemiparetic patients during reaching movements.
The principal aim is to determine whether the velocity of reaching movements involving elbow extension is mainly determined by spasticity or the motor deficit.
The secondary aim is to quantify the relationship between elbow flexor and extensor torque and elbow angular position relative to angular velocity. The long-term aim is to evaluate which of these variables are the most predictive of functional capacity.
Methods.– Twelve patients with spastic hemiparesis, troublesome elbow flexor spasticity and active range of elbow extension of at least 30° will be included. Patients with bilateral brain damage, severe apraxia and/or aphasia, cerebellar syndrome, or another cause of stiff elbow will be excluded.
Evaluations consist of a physical examination including use of scales (Fugl-Meyer, Action Research Arm Test, Motor Activity Log). Activation and control of the elbow flexors and extensors will be evaluated using an isokinetic dynamometer that records torque produced during passive stretch and concentric isokinetic torque at different velocities as well as isometric torque.
The kinematics of reaching movements will be evaluated using three-dimensional motion analysis. Spontaneous and maximal reaching velocity to two targets (65% and 90% of the upper limb length, in line with the shoulder) will be assessed. Surface electromyography will be recorded for each of the instrumented evaluations.
Results.– The relationship between elbow extension angular velocity in the reaching task, and stretch reflex threshold and flexor/extensor torque during passive and active isokinetic movements will be analysed using correlations.
The relationship between flexor and extensor torque produced during concentric isokinetic movements, angular position and elbow extension angular velocity will also be analyzed.
Discussion.– This preliminary work should give indications regarding the control of voluntary movements in hemiparetic patients. The collection of quantified data will assist in the appropriate adaptation of rehabilitation protocols, taking into account patient characteristics and should also help to specify indications for different rehabilitation techniques (physical, neuro-modulating and use of botulinum toxin or other pharmacological treatments).

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Ultrasound tracking for the identification of finger flexor muscles in the hemiplegic patient for a selective injection of botulinum toxin

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Keywords: Ultrasound tracking; Spasticity; Flexor digitorum superficialis and profundus stroke
Introduction.– Hemiplegia is often associated with a pattern of upper limb spasticity with adduction, internal rotation and flexion of the shoulder, pronation, flexion of the elbow, wrist and fingers flexion making it difficult to identify and to treat flexor digitorum superficialis and profundis with botulinum toxin. The progress of high-frequency ultrasound probes has for many years allowed a precise location of osteo-articular structures.
Objectives.– Our study aimed at assessing the feasibility of tracking flexor digitorum profundus and superficialis by ultrasound system in stroke patients.
Material and method.– Ten post-stroke patients with an Ashworth modified score of at least two on the main upper limb muscles and with the upper limb spontaneously placed with elbow flexion, pronation of the forearm and finger flexion were included. An ultrasound probe with a high frequency of 10 MHz was used for the ultrasonographic tracking.
Tracking sonography was performed in each patient's healthy side, in the anatomical position and then flexion and pronation of the elbow and finger flexion. Then, each patient underwent an ultrasound tracking in the hemiplegic side of the flexor digitorum superficialis and the flexor digitorum profundus.
Results.– The first set of ultrasounds allowed us to establish key benchmarks. Thus, from an axial section enabling to identify the biceps the brachial artery, then the pronator teres. The flexor digitorum superficialis was viewed from humerus, ulna and radius insertion. By moving the probe down, the flexor digitorum profundis could be identified. These two muscles, as well as the accompanying noble structures can be tracked until their distal end.
For patients with moderate spasticity, this technique allows a precise anatomical location of the flexor superficialis and profundis muscles. However, for patients with high spasticity this technique requires an assistant's help.
Discussion et conclusion.– This identification technique with ultrasound system is simple and allows us to consider highly selective and safe injections of finger flexor muscles. Patients with neuro-orthopedic deformities and therefore difficult access for botulinum toxin injections could benefit from this technique.

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Goal setting and attainment pertaining to upper and lower limb function in post-stroke spasticity (PSS) patients: The Botox® Economic Spasticity Trial (BEST)

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